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Southern Coal Fields Along the Southern Railway.

The coal lands of the Southern States, embracing some 80,860 acres, or nearly 40 per cent of the coal area of the United States, were practically untouched until 1880. Since that time there has been a development which is exceptional in the history of any industry. In 1887 the coal output of the South amounted to 18,471,922 net tons; and in 1897, to 36,981,601 tons, an increase in ten years of 100 per cent. This exceptional rate of progress has been owing to the rapid development of the iron industry and growth of numerous industrial establishments for which the South offers exceptional advantages. The increase in the output of coal is more apparent when contrasted with the growth of this industry in the Northern States. In 1887 the mines of these States produced 107,003,047 tons, and in 1897 the output was 152,676,027 tons, an increase of about 43 per cent, so the ratio of increase in the South was more than double that of the other States. Compared with the product of the United States at large, the South, in 1880, produced 14 per cent, and in 1897 some 24 per cent of the total bituminous output of the country.

In the manufacture of coke there has been a corresponding increase until, in 1897, out of a total of 13,288,984 tons produced in the United States, the South made 3,706,623 tons. In this year, out of a total of 336 coke plants and 17,773 ovens in the country, 140 plants and 7,773 ovens were in operation in the Southern States.

This has been the progress of only eighteen years. Prior to that time the transportation facilities in the South were limited, and, as a consequence, there had been little incentive to open and develop the various mineral resources of the States. There were few industries to use the product, and in view of the extensive and long-established iron and industrial manufactories in the North, it seemed hardly possible that new enterprises in an untried section would be able to compete with their product. But they have done so, and the progress made thus far, and within only a few years, bears most glowing witness to the immense possibilities which exist and await development in the future.

The coal area of the South is a part of the great coal field extending along the Appalachian chain from Pennsylvania into Alabama. In the regions extending from the Virginias through Southeastern Kentucky and Tennessee into Northwest Georgia and Alabama, there are extensive coal fields containing numerous seams of exceptionally good coal, for domestic, manufacturing and coke-making purposes. This region, which is amply provided with transportation facilities by the Southern Railway, is capable of extensive development, since but a small portion of it has, as yet, been opened for mining purposes, and large areas of land containing numerous seams of high-grade coals are untouched.

One of the most interesting features in the development of these Southern coal fields has been the exceptional opportunities which they have offered to persons of relatively small means for engaging in mining. With valuable coal lands selling at nominal prices, small ventures, economically conducted, have resulted in profitable enterprises, since not only has there been a remunerative market for the product, but the enhancement in values through the development of the coal properties themselves and the building up of industries using the fuel in near-by towns has brought about a double rate of growth and, consequently, of profit to those who have labored for this end.

Virginia Coal Fields.

Coal mining has been carried on in Virginia, near Richmond, for three-quarters of a century. These mines, lying in Henrico and Chesterfield Counties, are among the oldest in the country, and yield a coal of excellent quality for the manufacture of gas,

and for domestic and steam-making purposes. The field lies in the Jura-Triassic formation, similar to that found in North Carolina and, while not covering an extended area, has in it a number of thick veins which have been profitably mined, the output in 1897 being 95,670 tons. In Amelia and Powhatan Counties there are coal seams as yet undeveloped, and in Montgomery County a variety of semi-anthracite has been found. In the southwestern portion of the State are the important Pocahontas coal fields, which extend into West Virginia, Kentucky and Tennessee, and from which the greater portion of the State's production is derived, the total output in 1898 being 1,640,359 tons.

Kentucky Coal Fields.

In this State there are two coal fields, the Central and Appalachian. The former is relatively small and unimportant, while the latter extends over a large area in the southeastern part of the State—in Campbell, Whitley and Bell Counties. The coal output of the State has been restricted owing to prolonged strikes in the last two years, but in spite of this 3,602,097 tons were produced in 1897 and 3,572,134 tons in 1898. As yet there has been comparatively little development of the extensive coal territory in the southeastern section, and large tracts of land are available for future mining operations. In the region around Middlesboro the growth of production has been especially rapid, the output of Bell County in 1892 having been 7,971 tons, as compared with 89,534 tons in 1896 and 103,261 tons in 1897, the average price at the mines in the latter year being 92 cents per ton, as against an average of 79 cents for the entire State. Along the Cumberland Mountains, from Middlesboro to Jellico, are extensive beds of exceptionally-high grade coal; that mined at Jellico being famous throughout the South.

Coke made from Kentucky coal at Middlesboro has shown excellent results in tests made in the laboratory and the furnaces at Cumberland Gap. A report gives the following comparison with Connellsville fuel:

	Middlesboro Coke.	Standard Con- nellsville Coke.
Fixed carbon	94.66	87.46
Moisture	1.14	0.49
Ash	3.78	11.32
Sulphur	0.59	0.69
Phosphorus	0.007	0.029
Volatile matter	0.041	0.011

Coal in North Carolina.

In North Carolina little coal is mined. There are two fields in the State, the Dan River belt and the Deep River belt, the former having a width of from two to four miles, and a length of about thirty miles in northeast and southwest directions. While it has never been developed, it is thought that the prospects are fairly good. The Deep River belt extends from Oxford, Granville County, on the Southern Railway, southwest across the State. It is narrow at the extremes and about fifteen miles wide at its central point. One mine is being worked in this belt producing a good coking and also an excellent gas coal. The production of the State in 1897 was 21,280 tons.

Alabama Coal Fields.

The coal area of Alabama is divided into three fields, the Warrior, Cahaba and Coosa. The former is exceptional both as to area and the number and position of the workable seams of coal, nearly all of them lying above water level.

The following gives a fair idea of the area and unmined tonnage of these coal fields:

"The measures of the Warrior coal-field comprise 7,810 square miles, over 3,000 feet thick, with many seams of workable coal. These seams range in thickness from a few inches to twelve or fourteen feet. Estimating that the workable area of this coal is only 500 square miles and 75 feet in thickness, we would have a block of coal 75 miles long by 50 miles wide and 10 feet thick, or, say, 37,500,000,000 tons, enough to last about 10,275 years, at the rate of 10,000 tons per day. In the Cahaba coal-field the total area is 400 square miles, and the measures are some 5,000 feet thick. It has twelve seams of coal of a thickness of from 2½ to 12 feet, with a total thickness of from 40 to 50 feet. Estimating that the available coal in the seams will cover 200 square miles of 20 feet depth, we will have 4,000,000,000 tons of coal, which would last about 1,100 years, at the rate of 10,000 tons per day. The Coosa coal-field area is 345 square miles. Estimating the quantity of coal at 600,000,000 tons, we would have enough to last 65 years, at the rate of 10,000 tons per day."

	Short tons.		Short tons.
1880.....	380,000	1894	4,397,178
1885	2,492,000	1895	5,705,713
1887	1,950,000	1896	5,747,698
1890	4,090,409	1897	5,893,770
1892	5,529,312	1898	6,527,756
1893	5,136,935		

The United States Geological Survey states the average price of coal at the mines for 1897 at 88 cents per ton.

The Warrior coal field supplies the greater portion of the output of the State, and from it is produced most of the coke used at the iron and steel furnaces in the Birmingham district. Large shipments are made west to Greenville, Miss., whence the Southern Railway has established a barge line running to all points south of this, on the Missis-



DOUBLE COAL TIPPLE.

Brazil Coal Mines of Sloss Iron and Steel Company in Jefferson County, Ala., at terminus of Brazil Branch of Southern Railway. Photograph taken at time ground covered with snow.

issippi River, as far as New Orleans. This section was formerly controlled by coal shipped from Pittsburg, Pa., but the Alabama product has displaced its competitor and has a large, growing market for its fuel, especially since through the port of New Orleans foreign markets have been opened.

The most important mining counties are Jefferson and Walker—both tributary to the Southern Railway. Bibb, Tuscaloosa, St. Clair, Shelby and Etowah Counties also produce a large tonnage, and in all are extensive tracts of undeveloped coal property.

Average analyses of the coal from the different fields are stated by the Commercial Club of Birmingham, as follows:

WARRIOR FIELD.		CAHABA FIELD.		COOSA FIELD.	
	Per cent.		Per cent.		Per cent.
Moisture.....	1.02	Moisture.....	1.68	Moisture.....	1.43
Volatile matter.....	31.85	Volatile matter.....	34.13	Volatile matter.....	32.21
Fixed carbon.....	63.82	Fixed carbon.....	60.16	Fixed carbon.....	60.85
Ash.....	3.31	Ash.....	4.03	Ash.....	4.41
Sulphur.....	0.70	Sulphur.....	0.56	Sulphur.....	1.10

Coke making in Alabama is an important part of the coal industry, most of it being used in the iron and steel industry of the State. There are in Jefferson County 3,845 coke ovens; in Walker County, 750; in Tuscaloosa, 202; in Bibb, 467; other counties, 394; a total of 5,658. The production since 1880 has been as follows:

	Tons.		Tons
1880.....	60,781	1893.....	1,168,085
1885.....	301,180	1895.....	1,444,339
1890.....	1,072,942	1896.....	1,689,307
1892.....	1,501,571	1897.....	1,443,017

The quality of the coke is shown by the following analyses made at different oven plants in Alabama, taken from "Iron Making in Alabama," by Dr. Wm. B. Phillips:

Birmingham District Coke.

	PROXIMATE ANALYSIS.				ULTIMATE ANALYSIS.			
	Moisture.	Vol. and Com- bust. Matter.	Fixed Carbon.	Ash.	Sulphur.	Carbon.	Hydrogen.	Oxygen.
Black Creek.....	0.30	0.90	94.90	3.90	0.79	84.87	5.52	4.62
Blocton.....	0.10	0.66	93.20	6.10	1.05	83.18	6.43	3.14
Blue Creek, 48 hr.....	0.40	0.70	86.00	12.90	1.23	76.23	6.18	3.06
Blue Creek, 72 hr.....	0.05	0.90	87.25	11.80	0.99	78.27	7.38	1.51
Coalburg.....	0.70	2.55	81.15	15.60	2.21	75.25	4.25	1.99
Mary Lee.....	0.90	3.10	86.45	9.55	0.93	80.32	5.65	2.65
Pratt.....	0.90	1.40	89.80	7.90	0.82	77.86	7.10	5.42
Pratt, black ends.....	0.25	0.85	85.45	13.40	1.65	74.61	6.07	3.97
Standard (Brookwood).....	0.20	1.10	82.15	16.55	1.43	69.18	5.57	7.07
Standard (Milldale).....	3.05	2.50	86.80	7.65	1.47	76.63	3.56	7.64
Standard (Mixture).....	0.30	1.00	82.10	16.60	1.49	71.25	4.70	5.66
Gas Carbon (B'ham).....	0.20	0.70	93.20	5.90	1.23	84.27	4.61	3.79

Coal in Tennessee.

In Tennessee the coal-field is a solid belt, extending northeast to southwest across the State, varying in width from 50 to 70 miles, and covering 5,100 square miles of territory, the area covering, wholly or in part, twenty-one counties, mostly the East Tennessee counties. The land is an elevated plateau, ending in bold bluffs overlooking the valleys. Beneath the soil is a bed of conglomerate sandstone, averaging 70 feet in thickness, and under this are the coal measures. Under all parts of the table land there are from two to eight seams of coal, ranging in thickness from a thin vein to seven feet and more. There are about forty-five mines in operation in the State, the principal field being the Jellico district in Campbell County, the Anderson, Claiborne, Hamilton and Roane County mines on the Southern Railway and in Morgan, Scott, Rhea and some other counties on the Cincinnati Southern Railway. In 1897 Anderson County produced 557,696 tons, Campbell 328,494, Claiborne 270,927, Hamilton 211,959, Roane 173,383. The production of Tennessee in 1897 was 2,888,849 tons, which was worth at the mines an average of 81 cents a ton. In 1896 the average price was 84 cents. Campbell County had 12 mines, Anderson 6, Claiborne 4, Hamilton 3 and Roane 1 in operation in 1897.

Tennessee has long been a prominent producer of coke, ranking fourth among the coke-producing States, and being exceeded by Pennsylvania, Alabama and West Virginia. There are large coke plants in Anderson, Campbell, Claiborne, Hamilton and Roane Counties on or near the Southern Railway, at Coal Creek, Pioneer and other points. In 1896 there were 1,929 coke-ovens in the State; which number has been increased since that time.

The output of coal in Tennessee has been as follows in recent years:

	Short tons.		Short tons.
1880.....	641,042	1894.....	2,180,789
1885.....	1,440,957	1895.....	2,319,720
1887.....	1,900,000	1896.....	2,663,714
1890.....	2,169,585	1897.....	2,888,849
1891.....	2,413,678	1898.....	3,084,748
1892.....	2,092,064		

The coke production has been:

	Short tons.		Short tons.
1880.....	130,609	1896.....	332,746
1890.....	348,728	1897.....	368,769
1894.....	292,646	1898.....	394,545
1895.....	371,747		

The average value of coke at the ovens in 1896 was \$1.74 a ton, and the average yield of coal, in coke, was 56.7 per cent.

There has been much activity in coal lands recently, since a syndicate has made purchases of large areas of coal lands in East Tennessee and in Southern Kentucky adjacent to the Southern Railway. There are rich coal-fields in East Tennessee which are still untouched and offer excellent opportunities for further investment.

Georgia Coal Districts.

There are, in northwestern Georgia, a continuation of the Tennessee coal-fields. The seams are from 4 to 5 feet thick, and the quality excellent for coke, which corresponds favorably to that made from Pocahontas and Connellsville, and for domestic fuel. The product in 1898 was 244,168 tons, and the coke production was 49,529 tons. The coal averages from 61.69 to 83.22 per cent fixed carbon, while the ash is from 2.93 to 10.59 per cent; sulphur from 0.36 to 1.94, and phosphorus from 0.006 to 0.73, the average price at the mines being 72 cents per ton. The Georgia coke analyses average, fixed carbon, 90.31, volatile matter, 1.20; ash, 8.53, and sulphur, 0.53.

The Georgia mines are adjacent to Chattanooga, and their product is largely consumed by the near-by furnaces and factories.

Iron Deposits and Districts of the South.

The Southern iron district has for several years been one of the most important in the country, and at no period has its importance been more fully realized than at the present time. Within the past two years two developments greatly affecting the industry for good have taken place. These are, first, the establishment of a foreign market, in competition with the iron producers of the European countries, on the continent of Europe, and in England in the centers of the British iron industry; and second, the successful demonstration of the ability to produce cheap and first quality steel in the Alabama district, with the resultant establishment of the steel industry there upon a successful basis. These two developments are the result of the rapid growth of the iron industry in Alabama and Tennessee, and mark the ascendancy of the Southern iron fields of the United States in the production of cheap and good iron and steel.

The industry is an important one, employing a vast amount of capital; thousands of men; requiring the best skill and business acumen; giving the transportation lines a large traffic; reaching into the Northern and Southern markets and to many foreign ones; supporting and building up allied industries and bringing prosperity to the section in which it is located. It is still a growing industry, and the figures of this year, which will show a greater output than ever before, will increase with every year to come.

The iron industry of the South dates back over half a century. In 1850 Tennessee was the fourth State in the Union in the mining of iron ore, with a production of a little less than 100,000 tons. Ahead of her were Pennsylvania, Ohio and Maryland, and just behind were Kentucky and Virginia. That was in the days of charcoal furnaces, and the principal ones were in West Tennessee. Shipments were made to the North by the Cumberland, Tennessee and Ohio Rivers, and the iron was considered of very high grade. The passing of charcoal and the rise of coke furnaces have made a great change in the iron production, and the older furnaces of the South gradually gave way, though some few are still left and producing good iron. It was between 1870 and 1880 that the value of the red hematite ores of Alabama began to be appreciated by the people interested in the iron industry, and capital showed an appreciation of the opportunities in the iron-fields. In the same decade the red hematite ores of Tennessee also increased in value. In 1872 the production of pig iron in Alabama was 11,171 tons. There was a gradual increase in the amount thereafter, and the growth of the production has been steady and rapid. Now this State is the third iron producer in the Union. Tennessee dropped, as an iron-producing State, from its rank of fourth in 1850 to tenth place in 1880, with a small output. After that it again became prominent in the iron industry until now the annual production is upwards of 500,000 tons, and it is seventh on the list. It has many furnaces and the output of pig iron is large, as is the production of the prosperous rolling-mills and foundries. The principal mines and furnaces are in East Tennessee, Chattanooga being the center of the industry.

The production of ore in the South in 1897 amounted to 4,283,700 long tons. The pig iron production was as follows: Alabama, 947,831 tons; Tennessee, 272,130; Georgia, 17,092; Virginia, 307,610; Kentucky, 35,899; total, 1,580,562 tons, out of a total produced in the United States of 9,612,680 tons. In these States in 1898 it was 1,694,875 tons out of a total produced in the United States of 9,652,680 tons.

The low cost of Southern iron has given it an advantage in all markets of the country, and a very large percentage of the foundry iron used in the United States comes from the Birmingham and Tennessee districts. Within recent years the Birmingham district has been making basic pig iron to a considerable extent, supplying some of the open-hearth steel plants of the North, and since 1896 has been shipping it to Europe

The low cost of production in the Birmingham and Tennessee districts is due to several advantages: The low cost of ore; the proximity of good coking coal and consequent cheap coke, and the abundant supply of dolomite and limestone. These three things, together with an ample supply of excellent labor, cheap and contented, give these Southern districts an advantage over any possible competitor, and one which will always enable them to command the best markets of the world.

Tennessee Iron Fields.

The Tennessee iron deposits are divided into three districts, the Eastern, Middle, and Western. The Eastern district includes the counties of Polk, McMinn, Monroe, Blount, Sevier, Cocke, Green, Washington, Unicoi, Carter, Johnson and Sullivan, all of which are tributary to the Southern Railway lines in Tennessee. The Middle iron district embraces the counties of Hamilton, Rhea, Roane, Marion, Sequatchie, Bledsoe, Meigs, Anderson, Campbell, Union, Claiborne and Hancock, most of which are also tributary to the Southern Railway. The Western district comprises the counties in the State lying in the Tennessee and Cumberland Valleys and along these rivers. This latter was the pioneer district when the charcoal furnaces had a monopoly of the iron trade. The ore is a brown hematite of excellent quality.

The Middle district is at present the largest producer of Tennessee. The predominating ore is red hematite—commonly known as dye-stone ore of the Clinton epoch. Occasionally an area of workable thickness and quality of limonite is found. The Clinton ore extends along the eastern face of the Alleghenies from New York to Alabama. The outcrop in Tennessee is practically an unbroken line, skirting the base of Walden's Ridge, along its eastern escarpment from a point where it enters the State, to Big Stone Gap, where it crosses the northern border of the State. It is frequently found many miles from the base of the mountains; sometimes there are three or four parallel veins in close proximity. The ore occurs in a stratified form and varies greatly in thickness and in quality, its average thickness in Tennessee being about four feet. The ore is usually hard enough to be quarried out in blocks, but is sometimes soft and easily crushed, presenting the appearance of a scaly, specular ore. This ore produces an excellent quality of iron, and is the principal source of supply for the furnaces of the State. As in Alabama, there are locations in this district where the iron ore, limestone and coke are all found within a small radius, sometimes within two miles of each other, thus making possible the most economic production of pig iron. An average analysis of Roane County ore shows 50.20 per cent metallic iron, 9.70 silica and .58 per cent phosphorus.

The Eastern ore district includes those counties which border on North Carolina, lying immediately west of and at the base of the Unaka Range, with its outliers and included valleys and coves. While the developments in this district are not yet large it is probable that "it will become the most important ore producer of the State." (Tennessee Inspector of Mines.) The belt is the same as that extensively worked in Alabama, and enters Tennessee in Bradley County, passing through a portion of McMinn County, then on through the State to Johnson County, and into Virginia. It is a brown hematite similar to that of Virginia. As the belt enters Tennessee it is comparatively narrow, due largely to the fact that the ore lies in the foothills of the mountains, and the Hiwassee and Ocoee rivers have carried away many of the deposits. Passing into McMinn and Monroe Counties the belt widens and holds its width east in Blount and Sevier Counties. Very important bodies show in Sevier, none of which have been touched since the days of the old forges, which were once to be found on every stream. Great bodies of ore are found in Cocke and Greene Counties, and in Unicoi, Carter and Johnson Counties the belt widens to twenty-five miles. Brown hematite ores are the most important and abundant iron ores in this district, though there exists a valuable

deposit of magnetite of restricted area, and one detached deposit of red hematite in McMinn County. These deposits as a rule are near coal of good quality for coking. There is much available iron ore for development in this section of the State.

The blast furnaces of Tennessee number twenty-three, and have a daily capacity, when all are in operation, of about 2,200 tons. There are thirteen coke furnaces, all but one located in East Tennessee. On or near the Southern Railway are Citico and Chattanooga furnaces at Chattanooga, the Bristol furnaces, the Embreeville and the Carnegie furnaces. The Embreeville has recently started after long idleness and the Bristol furnace is about ready to do so. The output of pig iron in Tennessee since 1891 has been as follows:

	Tons.		Tons.
1891.....	326,747	1895.....	248,129
1892.....	300,081	1896.....	246,998
1893.....	207,915	1897, about.....	272,130
1894.....	212,773	1898.....	263,439

There are rolling mills and important foundries and other iron plants at Chattanooga, the iron center of the State, and also iron industries of magnitude at Knoxville, Harriman and other places.

Alabama Iron Industry.

The ore fields in Alabama cover an extended area, and while the limits are fairly well defined, it is probable that future developments will add much to the valuable ores now being worked. The ore regions and also the coal and limestone and dolomite regions, to a very great extent, lie along the Southern Railway and are tributary to it.

There are two iron districts in Alabama, the Birmingham, where the ore is mostly red hematite, and where is the great center of the iron industry of the South; and the Tennessee River district, where the brown ore deposits predominate. Both of these are tributary to the Southern Railway and most of the working mines, iron furnaces and mills are on the line of this road.

The iron deposits of the Birmingham district lie in Jefferson, Blount, St. Clair, Etowah, De Kalb and Cherokee Counties, the first being the principal iron mining and manufacturing county. The red hematite occurs in the Red Mountain formation that flanks the narrow anticlinal valleys between the coal fields in these counties, and are most highly developed in the Birmingham Valley between Birmingham and Bessemer. The hematites are classed as hard and soft ores, the soft carrying but little lime, while the hard has from 12 to 20 per cent of lime and in many cases is self-fluxing. As a rule the outcrop of the seams is soft ore and may extend from the surface for a distance of 300 feet on the dip, depending upon the thickness and imperviousness of the cover, although the hard ore comes to the surface at more than one place. The average grade of soft ore used in the Birmingham furnaces is about as shown by the following analysis given in the Tenth U. S. Census report:

Dried at 212° F., per cent.

Silica	13.66
Sulphur.....	0.11
Phosphorus.....	0.43
Alumina.....	6.13
Lime.....	1.26
Magnesia.....	0.37
Manganese protoxide.....	0.30
Iron protoxide.....	0.32
Iron peroxide.....	75.05
Carbonic acid.....	0.08
Carbon in carbonaceous matter.....	0.03
Water in composition.....	1.62—39 36
Metallic iron.....	52.87 per cent.
Specific gravity, 4.	

In a report on "Iron Making in Alabama," issued by the Alabama Geological Survey, Dr. W. B. Phillips says :

"An analysis of stock house samples shows :

		Dried at 212° F.
Iron.....	47.24	50.80
Silica.....	17 20	18.50
Alumina.....	3.35	3.60
Lime.....	1.12	1.20
Water.....	7 00	

In the early days of iron-making in Birmingham the furnace burden was almost entirely of soft ores. A better knowledge of the hard or limey ores was acquired, and the tendency of late years is decidedly toward a greater proportion of the latter, at time as high as 90 per cent. Dr. Phillips gives the average quality of the hard ore used as follows :

	Per Cent.
Water.....	0.50
Metallic iron.....	37.00
Silica.....	13.44
Lime.....	16.20
Alumina.....	3.18
Phosphorus.....	0.37
Sulphur.....	0.07
Carbonic acid.....	12.24

The brown ores or limonite were the first used in iron-making in Alabama, and practically all the charcoal iron produced in the State has been from them. They are also used to a considerable extent in some of the coke furnaces and produce an exceptionally good quality of iron. It was estimated in 1895 that almost 25 per cent of the total yearly production of ore of the State was brown hematite.

In the Birmingham District, brown ore deposits occur in Jefferson, Cherokee, Calhoun, Talladega, Shelby, Bibb, Tuscaloosa and Blount Counties. Dr. Phillips gives the following as the average composition of the brown ore of the State stock house delivery :

	Dried at 212° F.
Metallic iron.....	51.00
Silica.....	9.00
Alumina.....	3.75
Lime.....	0.75
Phosphorus.....	0.40
Sulphur.....	0.10

Selected brown ore may carry as much as 56 per cent of iron, on a dry basis.

In Jefferson County the Red Mountain ore veins, from which is derived the principal supply of red hematites, are only six or eight miles distant from the outcrop of the Pratt seam, in the Warrior coal field. The valley between this outcrop and Red Mountain has for its underlying foundation dolomite and limestone, and in this valley are Birmingham, Bessemer, Ensley and the great furnace and mill points of the Birmingham district and the Coosa Valley region. Within a very few miles are the iron

and coal mines, the dolomite banks, the limestone quarries, the coke ovens and iron furnaces and foundries; and at the furnaces all of the materials meet at the smallest cost. In the pamphlet issued by the Commercial Club of Birmingham in 1897 the cost of ore at the furnaces is given, approximately, for the grade and quality in general use, per ton of 2,240 pounds, as follows: hard red 75 cents, soft red 65 cents, brown \$1.00, all with the royalty included. The cost of the limestone and dolomite, at the furnace stock houses, ranges from 40 to 60 cents a ton. The limestone used has 95 per cent carbonate of lime and the dolomite 54 per cent carbonate of lime and 43 per cent carbonate of magnesia. The average cost of coke, running 10 per cent ash, f. o. b. at the blast furnaces, does not exceed \$1.75 per ton. The cost of producing pig iron in the district is not over \$6 a ton, and in some cases is materially less.

There are at present 39 coke and 12 charcoal furnaces in Alabama. The largest owner of mineral lands and producer of iron in the State, as also in the South, is the Tennessee Coal, Iron and Railroad Company. This corporation, which is also a miner of coal and maker of coke, has 13 furnaces in Alabama, of large capacity, and four in Tennessee. Of those in Alabama there are five at Bessemer, four at Ensley and two at Birmingham. The five Bessemer furnaces have a capacity of 800 tons daily and the four at Ensley the same, while that of the Alice is 300 tons, a total daily capacity of 1,900 tons, and an annual capacity of 584,000, which is about to be added to.

The Sloss Iron and Steel Company has on the line of the Southern Railway two furnaces in Birmingham and two in North Birmingham, with a total annual capacity of 200,000 tons. At Woodward, ten miles from Birmingham, are the two furnaces of the Woodward Iron Company, capacity 100,000 tons. At Thomas, the two furnaces of the Pioneer Mining Company have a capacity of 95,000 tons. The Trussville furnace has 30,000 tons capacity. The furnaces of the Sheffield Coal, Iron and Steel Company have 150,000 tons capacity. There are also the Hattie Ensley and the Lady Ensley furnaces. At Florence are the Philadelphia furnaces, capacity 45,000 tons, and the Spathite furnace; at Gadsden, the Gadsden furnace; at Talladega, the Talladega furnace; and at Birmingham, besides those mentioned, are the Williamson, the Mary Pratt and the Vanderbilt. There is a furnace at Fort Payne recently purchased by the Empire Steel and Iron Company of New York. Almost 80 per cent of the coke capacity of Alabama is on the Southern Railway.

In the Tennessee Valley district the brown hematites form the important ore deposits and are of exceptionally high quality. The principal deposits are in Franklin, Colbert, Lauderdale and Marshall Counties. The Sheffield and Florence furnaces, on the Southern Railway, use these ores entirely, the average shipments to Sheffield, over a long period, showing iron 53.67, alumina 5.58, silica 8.52, phosphorus 0.33.

The charcoal furnaces in the State on the Southern Railway lines are the Attalla, at Attalla, and Coosa at Gadsden, Etowah County; Bibb, at Brierfield, Bibb County; Decatur, at New Decatur, Morgan County; Jenifer, at Jenifer, Talladega County; Langdon, at Langdon, Rock Run, at Rock Run; Round Mountain, at Round Mountain; Tecumseh, at Tecumseh, Cherokee County; and Piedmont, at Piedmont, Calhoun County.

The production of iron ore in Alabama for a series of years has been as follows:

	Tons.		Tons.
1880.....	171,136.	1892.....	2,312,071.
1885.....	505,000.	1893.....	1,742,410.
1888.....	1,000,000.	1894.....	1,493,086.
1889.....	1,570,815.	1895.....	2,199,390.
1890.....	1,897,815.	1896.....	1,588,280.
1891.....	1,986,830.	1897.....	2,241,846.

The pig iron production was :

	Tons.		Tons.
1880.....	68,925.	1893.....	726,888.
1885.....	203,069.	1894.....	592,392.
1888.....	401,330.	1895.....	854,667.
1889.....	706,629.	1896.....	922,170.
1890.....	816,911.	1897.....	947,831.
1891.....	795,672.	1898.....	1,033,676.
1892.....	915,296.		

There has grown up in Alabama a great foundry and rolling mill industry and also many plants for the use of the manufactured iron. There are two immense rolling mills at Birmingham, pipe works at Bessemer and Anniston, stove plants and numerous foundries of one kind or another. These industries take a good share of the pig-iron production of the State, but the greater proportion has heretofore been shipped. The market has been in the pipe works, stove foundries and rolling mills of the Ohio Valley and other sections of the North, but after making basic iron the market widened. There was an immediate demand for that iron in Northern steel works, and in 1896 Europe began to buy it and now there is a steady market abroad. A list of the customers of Birmingham furnaces, making basic pig, published a year ago showed that it was sold to twenty-six manufacturing plants in Ohio, Pennsylvania, New Jersey, Massachusetts, New York, New Hampshire, Indiana, Illinois, Missouri and California, and to Italy and other European countries. Almost every maker of basic steel in this country is included among the users of this iron.

Steel-Making in Alabama.

It was in June, 1895, that the first basic iron made in the South on a commercial scale was turned out at the Alice furnace, Birmingham. The iron is of a superior quality, the average analysis of 126 casts of basic iron made at the Alice furnace showing as follows : Silica, 64 per cent, sulphur .034 per cent, phosphorus .73 per cent. The average specifications for basic iron are : Silica, not to exceed 1 per cent ; sulphur, not to exceed .05 per cent ; phosphorus not to exceed 1 per cent.

With the production of such good basic iron as was made at the Alice furnace, and is now produced there and at other furnaces, it became evident that the manufacture of steel in Alabama and the South was practicable. All the items which enter into the manufacture of open-hearth steel—pig iron, ore and limestone—were here at the lowest cost. There was also an abundant supply of scrap, which is used largely in making steel by this process.

The Birmingham Rolling Mill Company began in 1896 the building of an open-hearth steel plant, and in July, 1897, had completed a furnace and began making steel, which was successful from the start. Later, a second furnace was completed, giving the company two furnaces, of a capacity of about 40 tons per heat or about 160 tons per day. These furnaces are modern and complete and have been steadily and successfully operated since their completion while the steel has found a ready market, mostly in Southern industries using steel. The furnaces are adjacent to the rolling mills of the company and the ingots are carried at once to the mill and there rolled into boiler plate, fire box sheets, etc.

The quality of the steel manufactured in Birmingham is eminently satisfactory, as shown by analysis and by its extending use for armor plates, for boilers, for tools, and for all purposes. The cost of manufacturing steel at Birmingham is said to be from \$11 to \$12 per ton, which is cheaper than anywhere else in the country, if not in the world.

The maximum cost of converting pig iron into four-inch steel billets is estimated at \$5 a ton, and with \$6 pig iron this would make the cost of steel but \$11.

The second steel mill of the Birmingham district is now under construction and nearing completion. It will be owned by the Alabama Steel and Shipbuilding Company, a new corporation with a capital stock of \$1,000,000, organized by the Tennessee Coal, Iron and Railroad Company. It is located at Ensley, 6 miles west of Birmingham and adjacent to the Ensley furnaces, and will have a capacity of 1,000 tons a day, a market for a large portion of which is already secured. Other concerns will be located at Ensley, near the steel mill, to utilize its products, among them a wire mill, which will use 300 tons of steel a day.

The new steel mill will be one of the most complete plants of its kind. It will contain ten Wellman open-hearth furnaces of the latest and most improved type, each having a capacity of 50 tons per melt, the total being not less than 1,000 tons per 24 hours. The plant will have one new feature which will prove of interest to all manufacturers. This will be the supplementing of producer gas with 3,000,000 cubic feet of coke oven gas which will be received as a by-product from the Tennessee Company's Semet-Solvay coke ovens, located immediately alongside the steel plant. It is not contemplated at the outset to make a variety of shapes, and the product will be largely confined to billets down to $\frac{1}{8}$ -inch slabs, tin plate bars and rails.

Kentucky Iron Industry.

In southeastern Kentucky there are valuable deposits of hematite ore, a continuation of those in Tennessee. These lie near Middlesboro, the terminus of one branch of the Southern Railway, and where are the two Watt iron furnaces, with a daily capacity of 150 tons each. These, however, use in part ores from the Starr's Mountain outcrop in McMinn County, Eastern Tennessee. The pig iron output of the State in 1897 was 35,899 tons; in 1898 it was 100,724 tons.

Virginia Iron Industry.

There are large deposits of iron ores, red and brown hematite and magnetic ores in Virginia, and the iron industry of the State has been an important one for half a century. In the 50's it was one of the leading States in iron production and still remains one. In 1897 the pig-iron product of the State was 307,610 tons. In 1898 the production was 283,274 tons. In the territory tributary to the Southern Railway are numerous deposits of both brown and red hematite.

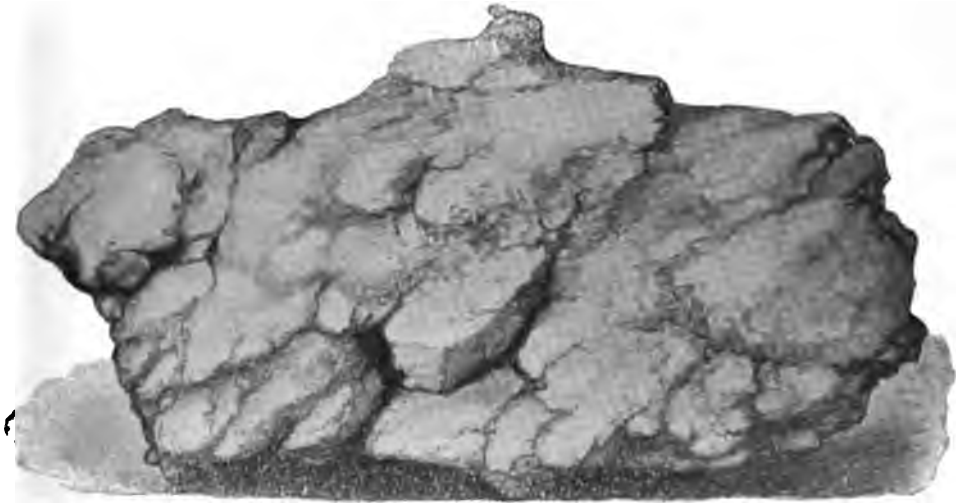
North Carolina Ores.

North Carolina has some valuable ore bodies. There are brown hematite deposits in Madison, Burke, McDowell, Cherokee and Chatham Counties; brown hematite and magnetite in Catawba, Lincoln and Gaston Counties; magnetite ores in Stokes, Surry, Yadkin, Ashe, Mitchell and Madison Counties, and magnetite and specular ores in Granville County, and some other deposits. The best known ore deposit in the State is the Cranberry ore in Mitchell County, near the Tennessee boundary. This is a magnetite ore of very fine quality. It was worked in a small way, in Catalan forges near by, as far back as 1820 and produced excellent iron. A narrow-gauge railway was built to the mine from Johnson City, Tenn., on the Southern Railway, and a small blast furnace was several years ago erected near it. The mine and furnace are not now being worked, however, but will doubtless be started at an early day if the good condition of the iron and steel market continues. It is said that arrangements have been made to open them at once to supply the Embreeville furnace. An analysis of furnace ore from the stock house of the Cranberry mine showed: Silica, 26.90; metallic iron, 44.00; sulphur, 0.008; phosphorus, 0.019; phosphorus ratio, 0.043. Another

analysis of a stock house sample showed 40.85 per cent metallic iron and 0.026 phosphorus. An average analysis of fine concentrates, Cranberry mine, was: Silica, 8.33; metallic iron, 63.41; metallic manganese, 0.24; alumina, 0.41; lime, 3.12; magnesia, 0.49; sulphur, 0.045; phosphorus, 0.004; phosphorus ratio, 0.006.

Georgia Iron Ore Deposits.

In Georgia there are deposits of brown hematite in Polk, Floyd, Gordon and Whitfield Counties, along the Southern Railway, and in some other counties. The deposits are quite extensive, and the ore of a good quality. Considerable is mined in Polk County, and some in Floyd. Red hematite, like the Alabama-Tennessee deposits, is found in the northwest counties adjacent to Tennessee and mined quite extensively. There is a furnace at Rome, on the Southern Railway, which is a successful iron manufacturing point. The pig iron production of Georgia in 1898 was 13,762 tons.



NUGGET FOUND AT REED MINE, CABARRUS CO., N. C., NEAR SOUTHERN RAILWAY,
APRIL 10, 1899. WEIGHT 22 POUNDS. PICTURE ONE-EIGHTH ACTUAL SIZE.

Gold in the South.

The gold belt of the South is a very extensive one. It follows the Southern Appalachians, appearing in the Piedmont and mountain regions from Virginia to Alabama. The general trend is from northeast to southwest, and the gold-bearing regions are nearly all along or near the Southern Railway's main line from Washington City southwest, or some one of its numerous branches leading out from that line. The belt is nearly 700 miles long and from 50 to 120 miles wide. This area may be divided into several minor gold-bearing belts: (1) the Virginia belt; (2) the Eastern Carolina belt; (3) the Carolina State belt; (4) the Carolina igneous belt; (5) the King's Mountain belt; (6) the South Mountain belt; (7) the Georgia belt; (8) the Alabama belt.

In some of these minor belts there is at present a good amount of work being carried on, and several mines are yielding a good profit. These are the mines where the latest and most approved mining and milling methods are in operation, by which the low-grade ores can be utilized. In former years the gold-fields of the South, especially of North Carolina and Georgia, yielded quite heavily, and had a most important position among the gold-fields of the world. In those days mining methods were crude, and as soon as the old methods became unprofitable the mines were abandoned. In recent years new attention is being given to the South by gold miners. The possibilities of the field are again being realized, and exploration and development work is being done in many places, while at others the mining industry is being steadily pushed. This is owing to the introduction of the new methods, and especially of the chlorination process of extracting the gold from low-grade ore. The ores of the Southern field are mostly low grade, but there are many mines which yield a fair amount per ton. By the Thies process, low-grade ores are worked with good profit. Some of the old mines, long since abandoned, are found to have ore sufficiently rich to work, and new discoveries are being made. The Southern gold-fields are probably destined to again assume a very great importance among the gold-producing regions of the country. They will, at least, furnish work for many men and bring fortunes to many who understand modern mining methods. Many authorities in mining matters predict that this gold field is to become one of the greatest gold-bearing belts of the continent. The field will certainly bear and warrant the most careful investigation of mining men.

Gold in Virginia.

A considerable amount of prospecting and mining work has been done in Virginia, and there are some promising deposits in the Virginia belt, which begins at the Maryland line and extends into North Carolina and lies just east of the Blue Ridge. It has a width of from 10 to 20 miles and covers an area of about 4,000 square miles, mainly in Culpeper, Fauquier, Stafford, Orange, Spotsylvania, Louisa, Fluvanna and other near-by counties. The country rocks are mainly mica, gneiss and mica schist. They have a general strike of N. 20-30° E. and a varying easterly dip. The gold is usually carried in irregular lenticular quartz veins, which lie more or less parallel to both the strike and dip of the rock, and vary in width from a few inches to several feet. In many cases both the vein quartz and the slate walls are impregnated with gold-bearing pyrites. Most of the gold thus far obtained has come from the veins and the contiguous schists. A considerable number of mines have been opened up. A Virginia Miner writes: "The permanent and lasting wealth of this gold-field will be found in the untold millions of tons of low-grade ores. Later experience has proven that these ores have an increasing value as depth is obtained."

Gold in the Carolinas.

The geological formation of North and South Carolina extends partially or entirely across the territory of both these States. The oldest record of a gold deposit in the United States mint was in 1804, and from that year to 1828, inclusive, North Carolina furnished all the gold produced in this country, amounting to \$110,000. During 1829 the first returns came in from Virginia and South Carolina, in 1830 from Georgia, in 1831 from Tennessee, and in 1840 from Alabama. There was a marked decrease of the production for a few years following 1830, from the partial exhaustion of the more accessible Virginia placers. Attention then began to be paid to vein mining.

The Eastern Carolina belt comprises an area of about 300 square miles in Halifax, Warren, Nash and Franklin Counties. The Carolina slate belt comprises an area of 8 to 50 miles wide, extending in a southwesterly direction across the central part of North Carolina into the northern part of South Carolina, where it appears to sink beneath the coastal plain, and reappears in the eastern part of Georgia. The Carolina igneous belt adjoins the slate belt on the west, and has a width of from 15 to 30 miles. The Kings Mountain belt lies to the west of the igneous belt, extending across North Carolina. The productive points are widely scattered, and constitute a small area. The South Mountain belt begins in the western part of North Carolina, in Caldwell, Burke, McDowell and Rutherford Counties, on the eastern flanks of the Blue Ridge and extends into North Carolina.

The gold deposits of the Carolina are placer, divided into stream gravel, gulch and rotten-rock deposits; quartz fissure veins containing free gold and gold in combination with sulphurets, and impregnations of free gold and finely divided auriferous sulphurets in the country schists and slates. The area and extent of the Southern placer deposits are limited. The quartz veins vary greatly in value. The concentrated sulphurets run from \$30 to \$40 per ton after the extraction of the free-milling portion, which may be from 20 to 50 per cent of the value of the ore. The large body of low-grade auriferous schists may yield anywhere from \$2 to \$5 per ton in quantity.

There are few gravel mines in operation at present. The Crawford mine, near the Southern Railway, in Stanley County, was opened in 1892. The gold occurs almost exclusively in the shape of nuggets. In April, 1895, an 8-pound nugget was found, and in August the same year one weighing 10 pounds. The mills and other mines in Burke County are on ground previously worked over three or four times at intervals of several years.

The best known and most extensively worked district in North Carolina is the Gold Hill district at the junction of Rowan, Stanley and Cabarrus Counties. There are mines in that district, which have yielded more than \$3,000,000. New machinery and new methods are being adopted in that district. The country rock is chloritic and argillaceous schist with the usual northeast by southwest strike, and dipping steeply to the northwest. For a considerable area the country rock is more or less impregnated with gold-bearing pyrite, the pyrite being concentrated into more limited belts, in which are numerous lenticular veins and small stringers of gold-bearing quartz. At the mines in Cabarrus County a Thies chlorination plant has been put in for common use, and the owners expect to reap steady profits. There are some good deposits in Cherokee and other counties in southwestern North Carolina.

At the Haile mine, in Lancaster County, South Carolina, is successfully shown the working in low-grade ore. The auriferous bodies are lenticular in shape, about 200 feet in length and 100 feet in maximum width. The pitch is from fifty to sixty degrees northeast and the dip forty-five degrees northwest to vertical. The ore consists of silicified sericitic schists, impregnated with free gold and sulphurets (pyrites from 2 to 25 per cent). Average assay is about \$4 per ton. The greatest depth of the workings is

about 270 feet. The mill is a 50-stamp one and treats 120 tons a day. About 33 per cent of the gold is free milling, and the percentage of extraction is from 75 to 80 per cent. The concentrates from twenty Embrey tables amount to about 8 tons in twenty-four hours, and assay from \$25 to \$35 per ton. They are treated in a three-barrel Thies chlorination plant, where the extraction averages 94 per cent. The Brewer mine is, next to the Haile, the best known and most productive of the South Carolina mines. It is located about 8 miles northeast of the Haile. Its ores average about \$3 per ton.

The Georgia Gold Deposits.

The Appalachian gold belt enters the northeastern corner of Georgia from the Carolinas and runs through the State in a southwestern direction to the Alabama State line. The region traversed is more or less mountainous, especially in Rabun, Union and Towns Counties. Further to the southwest the country becomes more or less undulating, the principal topographical features being low, rounded hills and narrow valleys, with an occasional isolated mountain. The section is well watered and heavily wooded. The streams furnish ample water-power for stamping and other machinery.

The greater part of the gold found occurs in the Dahlonega and Hall County belts. The former takes its name from the county-seat of Lumpkin County. This belt makes its appearance in Rabun County and runs through Habersham, White, Lumpkin, Dawson, Cherokee, Paulding, Haralson and Carroll Counties. Placer mines in Rabun County have been worked on and off for fifty years. In White County the belt widens and mines are more numerous. Both placer and vein mining are carried on here. In Lumpkin County is the richest part of the belt, and mining operations have been carried on successfully since the opening of the first mine in 1829. The belt narrows and breaks in Dawson County, but regains its importance in Cherokee County. The Hall County belt lies about ten miles east of the Dahlonega belt and runs southwest to Fulton County, eight or ten miles north of Atlanta. A third belt traverses Cobb, Paulding and Carroll Counties, with its greatest development near Villa Rica, where it has been extensively worked. A fourth belt traverses Lincoln, Columbia, McDuffie and Warren Counties.

The individual auriferous belts are generally made up of several veins or ore bodies, running more or less parallel with each other, and conforming in dip and strike to the country rock. They vary in thickness from a fraction of an inch to several yards. One of the typical veins is a series of ore shoots. At the Creighton mine, Cherokee County, are two ore deposits a few yards apart, parallel with each other. The shoots occur at intervals of every few rods along the outcropping of the vein. The so-called stratified deposits are of common occurrence, and are noted for great thickness. They are well represented at Crown Mountain and the Jumbo Mines in the Dahlonega district. One of the most typical examples is at the Banner mine, Carroll County. There the ore body is of uniform size. It is formed of numerous layers of quartz separated by thin layers of schist. Both the quartz and the schist are gold-bearing. The deposit is at least 75 feet thick.

The ores of the various auriferous deposits of the State are of low grade usually, and are free milling and sulphurets. The free milling areas are confined chiefly to the superficial parts of the vein and ore bodies. They extend to various depths, often 100 feet or more beneath the surface, and are at present the source of the greater part of the gold mined in the State. The sulphuret ores are chiefly met below the water level and are mainly made up of white quartz, carrying auriferous pyrites.

Modern mining machinery is in use at many places in the State, and work is being carried on successfully at a great many mines. In the Dahlonega district the greater part of the ore is obtained from saprolites, a term used to designate the decomposed ore bodies in place. The hydraulic giant is used in mining these ore bodies, which are the



Hydraulic Mining in the decomposed auriferous slates, with their vein contents, at the Singleton Mine, Dahlonega, Ga., tributary to the Southern Railway at Gainesville, Ga.

superficial oxidized portion of the "stratified deposits" or ore shoots. It is a cheap method. The ore is carried away from the giant by the rushing waters, caught up in the flume or sluice-boxes, and conducted to the stamp-mill. Deep mining is carried on only at the Creighton mine, the Royal, near Tallapoosa, and a few other mines. The chlorination process is used in the treatment of the low-grade sulphurets in these mines. There are a number of good mining properties in the State, near the Southern Railway, which are being developed. Recently much outside capital has gone into gold properties. There are immense fields of low-grade ore which need capital to develop them, and which give every promise of profit.

There is every prospect of a smelter being erected in the Georgia district.

Alabama Gold Regions.

The gold district of Alabama lies in Cleburne, Randolph, Clay, Coosa and Tallapoosa Counties. In these counties there are several localities where there is a sufficient quantity of low-grade ore to justify working. In Cleburne County, at Arbacoochee, placer work has been carried on more extensively than in any part of the State, except possibly in the vicinity of Goldville, in Tallapoosa County. At present little is being done in either district. The Chattanooga Mining Co. is doing some work and has recently taken out a number of good sized nuggets along with the fine gold. An exceedingly rich vein of quartz carrying free gold was discovered at Arbacoochee. To the east of Arbacoochee in the Tricken Valley there is much activity in the way of development. At the Hicks-Wise shaft, at a depth of 150 feet, a fairly good grade of ore is found. The width of the ore body at the surface is about thirty feet. Up to this time no plant for utilizing the sulphurets has been introduced in Alabama. The developments show, however, a sufficient body of low-grade ore occurring at several places in the gold belt to justify the erection of milling plants, and of chlorination plants for the sulphurets.

In Tennessee.

Gold deposits in Tennessee occur in Monroe, Blount and Polk Counties. They lie on the western slope of the Great Smoky Mountains and on the North Carolina border. At Coca Creek, Monroe County, the Whippoorwill Mining Company has a vein of gold-bearing quartz in semi talcose clay slate. The gold also occurs at Coca Creek in sandstone gravels. There are veins of gold-bearing quartz in the Ocoee group of slates.

Precious Gems.

In North Carolina many precious gems are found and the State has acquired the name "Gem State." Even very valuable diamonds have been found. The list of precious stones includes the hiddenite, emerald, smoky topaz, sapphire, sagenite, amethyst, rose garnet, citrine topaz, ruby, cyanite, quartz crystals, tourmaline, cornelian, jasper, chrysolite, lazolite and spinel. Besides these, in both North Carolina and Tennessee, valuable and beautiful pearls are found in certain varieties of fresh-water mussels living in the larger streams. Experts have said there is money in prosecuting the gem industry in the "Gem State," providing it is conducted on the same technical lines as are practiced in Europe.

Phosphate Rock.

There are large deposits of valuable phosphate rock in South Carolina, Tennessee, and other Southern States. There is a good field for prospecting for commercial deposits along the Southern Railway in Virginia, Tennessee, Alabama and Kentucky. Some prospecting in the valley of Virginia resulted in the location of the horizon of the phosphates of Juniata County, Pennsylvania, with the accompanying Helderburg limestone and Oriskany sandstone. A bed of soft marl phosphate has been uncovered in the Virginia Valley. The new, and now largely phosphate rock producing field of middle Tennessee extends geologically southward through Wayne County, Tennessee, and Lauderdale County, Alabama, and its accompanying rocks show up along the Memphis Division of the Southern Railway. While the analyses of rock in these counties show a low per cent of phosphate of lime (in some cases, however, as high as 20 per cent), there is every reason to justify close prospecting for this most valuable rock.

Manganese.

There are several rich deposits of the very valuable mineral, manganese, in the Southern States. Virginia is exceptionally rich in manganese mines, which exist in Augusta, Rockingham and other counties. A very large deposit of high-grade ore has recently been developed in Campbell County, south of Lynchburg. The Rockingham mines have been the largest producers in the United States. In South Carolina manganese is found in Abbeville, Aiken, Anderson, Cherokee, Edgefield, Laurens and York Counties. Extensive deposits exist near Blacksburg, Cherokee County, on the Southern Railway. The ore is hard, crystalline, manganese dioxide. Georgia is a large producer of manganese, mining about 4,000 tons a year of manganese oxide. The principal deposits are in Floyd, Polk and Bartow Counties, the first two named being along the Southern Railway. The largest shipping point is Cave Spring. There are numerous manganese prospects in Tennessee and Alabama.

Marble, Granites and Other Stones.

The marbles of the South are of wide variety and of fine quality and the deposits are very extensive. The oldest quarries are in East Tennessee, in the Southern Railway territory, and they form one of the most important industries of the South. In a paper read before the Tennessee Industrial Convention, Mr. J. E. Willard, of Knoxville, said of the marbles of that State:

"Geologically considered, the Tennessee marbles can be referred to the Trenton and Nashville series, which are the overlying beds of the lower silurian formations. All these formations strike northeast and southwest, and vary from horizontal to dips of high angles. Of the colored marbles, there are endless varieties, from the most delicate pink to the rich brown and chocolate, the gray and the dark variegated. This great diversity extends to the texture as well as the color, and the widest possible field is afforded to architects and artists in stone to exercise their taste in the selection and combination of colors. It is only of late that this diversity in these marbles has been known to the trade. The lighter colors, such as the gray and the different shades of pink, seem to meet the popular fancy. As shown by chemical and crushing tests, these marbles are practically impervious to moisture and discoloring agencies, and have all the requirements of a first-class building material—a material that will last for generations. At the present time there are fourteen quarries in operation in Knox

and Blount Counties with an average output of 30,000 cubic feet per month. This product is of the different varieties and colors, and is shipped all over the United States, from Maine to California, in the rough block, in sawed slabs, and in the finished state for the interior decoration of buildings. There are four mills located in Knoxville, which finish and ship marble to the trade. There are over three million (\$3,000,000) dollars invested in Tennessee marble."

The Georgia marbles have come into great favor within the past few years. They are of fine quality and variety, strong and durable, of various colors, taking a fine polish and suitable for exterior work, interior finishing or for monumental purposes. Some of the best deposits in the State are undeveloped. The marble is found in Whitfield County for a distance of ten miles or more along the Southern Railway. This marble belongs to the same belt which traverses the valley of East Tennessee. It is generally of a dark chocolate color, variegated with white, but there is also a light gray and a beautiful pink. In the Coosa Valley of Alabama and especially in Talladega County, are large deposits of marble of various colors and of excellent quality and fine texture. There are deposits in Western North Carolina. Virginia has a variety of marbles within her borders. In Loudoun County is a beautiful white marble; in Campbell and Pittsylvania Counties white, mottled, gray and other colors. Marbles also occur in Nelson and other counties.

Granites of the South.

The building stones of the South include a great variety of granite of excellent quality and great beauty, brownstones, etc. Granite is found in several places in Virginia. The Richmond granite deposits are noted. They are very extensive.

There are fine granite deposits in North Carolina at several places in the Piedmont region. Near Mt. Airy are large quarries. In Floyd County there is a light gray granite with medium fine texture, and also a gray gneiss of medium fine grain and uniform in texture and color. There are granite deposits in Guilford, Alamance, Surry, Rowan, Iredell, Davidson, Mecklenburg, Gaston, Granville, Vance, Cabarrus, Wake, Davie, Wilkes, Wilson and other counties. The Wake County granite is a light gray quartzose gneiss. At one place a pretty pink granite is found. In Rowan County, near Salisbury, are extensive quarries. Several kinds and qualities of granite are quarried here, used for paving, curbing and architectural purposes. Near Gastonia is a fine-grained gray granite, used for monuments, trimmings, etc. Another location in Gaston gives a light gray granite with a pinkish tint, hard, uniform color and texture, and desirable for building purposes. In the northern part of Wilkes County is an enormous mass of gray granite known as Stone Mountain. Near Charlotte is a fine-grained hornblende granite, used for monumental purposes, for trimming, etc. Near Concord, Cabarrus County, a deep pink granite is found. At Mooresville a fine-grained gray biotite granite is quarried, for monuments and building. In Davie County, on the Yadkin River, is a beautiful spotted stone, called orbicular granite. A white granite, closely resembling marble, is found in Alamance County, near Burlington. The Surry granite is a medium fine grained light gray.

In South Carolina are fine deposits of granite, and some of them are widely known. As a rule the granite is of a uniform color, slightly flecked with black, susceptible of the finest polish, impervious to weather, with a cleavage as smooth as wood; it whitens with age and looks like marble. It is found in abundance in the Piedmont and near the Sand Hill regions along the Southern Railway. There are some very extensive quarry companies which ship granite all over the South and North. It is used for buildings, finishing, monuments and paving. At Winnsboro, on the Southern Railway, are extensive quarries. The Winnsboro granite is properly hornblende granite. It is hard, durable, but easily worked. There are white, gray and blue granites. The Edgefield, S. C., granite deposits await development.

Beautiful beds of the best quality of granite occur in Georgia in several localities, and the output is large. The Stone Mountain deposit east of Atlanta is a fine stone. It is shipped to many parts of the country. At Elberton are quarries of a beautiful fine grained blue granite. Alabama has several good beds of granite.

All along the Southern Railway are good deposits of building stones which have not been fully developed or worked, but which are known to be of excellent character.

The sandstones of the South are numerous and of fine quality. In many localities along the Southern Railway they are of the most beautiful color. There is a brown sandstone in Nelson and Albemarle Counties, Virginia. There are other good building stones in Virginia. North Carolina has fine sandstones in Wake, Moore, Durham and other counties. Near Chapel Hill there is an excellent new red sandstone. It is very durable. In Durham County are quarries of light brown, fine grained stone of a coarse gray color, of reddish and grayish brown. Georgia and Alabama are both rich in sandstones of superior quality.

Tennessee has some very fine beds of sandstone as well as other good building stones. This stone, and also the sandstone of Kentucky, are easily worked, of good appearance, and correspond to the "Ohio stone." The limestones of these States resemble the Indiana stone. Good limestones for building purposes are also found in Alabama, Georgia and Virginia. Other stones are the serpentine of Loudoun County, Virginia, and of North Carolina, and the greenstone, near Lynchburg, Va.

Limestone and Dolomite.

The limestone deposits reach to a large extent the States of the South and afford a practically inexhaustible supply, whether in building stones or for working lime or for fluxing purposes. In Virginia the limestone is found in the western and southwestern part and in other sections. From the pure limestone, largely found, lime is made in great quantities, while a superior cement material is had in the magnesian limestone. This magnesian limestone is also largely used to eliminate phosphorus in the basic-steel process. There are good deposits of pure and also magnesian limestone in Georgia, and a considerable product of lime and also of cement is turned out in the State. In Alabama are vast deposits of both limestone and dolomite. The latter exists in greatest quantity near Birmingham and plays an important part in the making of basic steel in the Birmingham district. There are extensive limestone and dolomite—magnesian limestone—deposits in Tennessee, and, besides, the Tennessee marble deposits are so pure that they can be used for both lime making and fluxing. In South Carolina the limestone deposits are in York, Spartanburg, Laurens, Pickens and other counties.

Slate.

There are some very fine deposits of slate in the South. In Virginia there is a deposit near North Garden station on the Southern Railway, in Albemarle County. The extension of this deposit, near the main line of the Southern Railway, is well worth prospecting. In the valley of Virginia are several slate outcrops. In Blount County, Tennessee, is a large deposit. This is the southern extension of the Western Pennsylvania slate belt. Considerable beds of slate exist in Georgia, in the southern areas of the Piedmont slate belt, which parallels the Southern from Virginia to that State. Beautiful slate of the best grade is quarried at Rockmart, Polk County, Georgia. The Virginia slate belt is known to extend into North Carolina and lies near the Southern Railway.

Corundum.

The corundum belt of the Southern Appalachians reaches from Virginia through North and South Carolina and Georgia into Alabama. Corundum has been mined in Georgia and probably will be again, but at present the only active corundum mines in the United States are in North Carolina. It is found in Iredell, Alexander, Burke, Cleveland, Gaston, Guilford, Mitchell, Yancey, Madison, Haywood, Buncombe, Transylvania, Jackson, Macon, Cherokee and Clay Counties. There are mines at Corundum Hill and Dillsboro, Macon County. The Carter mine is in Madison County, the Acme in Iredell, and others in Clay County. The Sapphire mines are a series of mines in Jackson and Transylvania Counties. In Georgia corundum has been found in Rabun, Towns, Union, Lumpkin, Habersham, Hall, Cobb, Douglas, Paulding, Carroll and one or two other counties. Corundum is reported in Laurens, Anderson and Oconee Counties, South Carolina.

Kaolin and Clays.

The clay deposits of the South are very extensive and of a most valuable kind. In nearly every State are found wide areas of workable clays and in very many regions the best of pottery clay. The deposits of Georgia are in great abundance and of excellent quality. Some of the kaolins of this State are white and some of a yellowish tint. The



KAOLIN MINE.

Harris Clay Company, near Webster, N. C., tributary to Southern Railway.

white clays are excellent for chinaware and the others for fire brick, for use in ornamental bricks and earthenware, cloth, wall-paper, etc. In Alabama are good deposits in a great many localities of kaolin and of clays, and the same is true of Tennessee. Calhoun County, Alabama, has very fine kaolin. In North Carolina are unusually fine deposits. The finest of kaolins exist in the State in Jackson and Macon Counties.

The Dillsboro kaolin, Jackson County, is said to be unsurpassed for chinaware. Pottery clays are found in Burke, Catawba, Wilkes, Lincoln and other counties, and there are a number of potteries in the State. Fire clays and pipe clays are utilized in Guilford and Cleveland Counties. There are good brick clay deposits in Buncombe, Burke, Cleveland, Forsyth, Gaston, Guilford, Jackson, Mecklenburg, Rowan, Surry, Union, Wake, Wilkes, Wilson and other counties. South Carolina has rich deposits of kaolin, terra cotta, fire and brick clays. In Aiken, Richland and Edgefield Counties there are fine kaolin deposits and also potteries. Kaolin is also found in Amelia, Fluvanna, Chesterfield, Amherst, Nelson and other Virginia counties. It is of good quality. Fire clay exists at many places, and other clays of fine quality are scattered over the State in great quantity. Clays are found in many sections of Mississippi.

Copper.

There is a fine chance for developing the copper ores along the Southern Railway. The application of the latest metallurgical methods ought to enable a number of abandoned mills to be worked profitably, inasmuch as it is now possible to recover all the gold and silver at comparatively small cost from the copper matte by electrolysis, thus adding greatly to the margin of profit. Many of these copper ores are accompanied by iron pyrites, and the chalcopyrite ores abound in sulphur, which could be utilized as a by-product. North Carolina is full of copper mines, and its gold mines often carry seams of copper, so that with a plant to save both metals, many a now abandoned mine might be utilized. Among the copper mines of North Carolina we call special attention to those of Rowan, Guilford, Person, Davidson and Ashe Counties, at the same time noting that there are other counties in which copper occurs. A number of the gold mines about Charlotte, N. C., carry copper pyrites in seams through the mines. Copper at one time was largely mined in the Blue Ridge Mountains in Virginia. It occurs in Fairfax, Madison, Nelson and other Virginia counties. It is mined in Polk County, Tennessee, in what is known as the Ducktown district. This district is located in an elevated basin of forty square miles among the mountains. Smelting and refining works were erected in 1860, and since then a populous community has thrived upon the industry. In Northeastern Alabama are found fine prospects.

Beauxite and Aluminum Ore.

The increasing demand for alumina makes the mining of beauxite or aluminum ore a profitable business. It has been the good fortune of the State of Georgia to be the first in the market in supplying the demand for beauxite, and the product of the Empire State of the South has won a first place as to quality and quantity, to such an extent that Georgia ore is preferred to that imported from France. Alabama, also, holds a leading place; in fact, these States are supplying the home market with beauxite. The value of beauxite is regulated by the price of the imported ore, which can be delivered in Philadelphia or New York at about \$6.50 per ton. But the Georgia-Alabama beauxite commands a higher price on account of its easier solubility compared with French ores. It has been sought for shipment to Germany. As much as \$8.50 to \$13.00 per ton have been paid for Georgia beauxite in Pittsburg, Pa., and Syracuse, N. Y.

The deposits of ore on the Southern Railway are located in Floyd County, Ga., and near Piedmont and Rock Run station, Ala. With the increasing demand a largely augmented business is assured in the near future. The uses to which aluminum is being applied are constantly increasing. It has been proposed to use beauxite as a

lining for steel furnaces, for which it is suited owing to its refractory nature. Should it come into extensive use for furnace linings a greatly augmented demand will be created.

The following is an analysis of beauxite from a mine near Cave Spring, Floyd County, Ga., on the Southern Railway :

Alumina.....	58.61
Ferric oxide.....	2.63
Silica.....	8.29
Water.....	27.42
Titanic acid.....	3.15
	<hr/>
	100.00

Titanic acid does not injure this ore. Another analysis taken from ore in the same region is that of ore from the Julia mine. It is as follows :

Alumina.....	67.53
Ferric oxide.....	Trace
Titanic acid.....	2.92
Silica.....	1.34
Water.....	28.00
	<hr/>
	99.79

The beauxite seems to be chiefly associated with the lower beds of the Knox Dolorite, of the Lower Silurian formation. The ore usually occurs associated with limonite, iron ores and manganese.

Monazite.

Monazite is now a very valuable mineral as it is a very rare one. Its use is in incandescent gas burners and the demand is large. North and South Carolina has in the port shipped considerable monazite. The Carolina workable deposits are in Burke, McDowell, Rutherford, Cleveland and Polk Counties, North Carolina, counties adjacent to the Southern Railway, and Spartanburg and Greenville Counties, South Carolina. The mineral is also found in Amelia County, Virginia.

Graphite.

Graphite in small quantities is widely distributed in North Carolina. It is principally found in Gaston, Lincoln and Catawba Counties and in Wake County. The Wake County beds are the most extensive and best known. In Virginia graphite has been found in Amelia, Patrick, Campbell, Loudoun and other counties, some deposits being very pure and in large quantities. Graphite exists in a number of counties in Alabama. There are also several deposits in Georgia. In South Carolina deposits are reported in Anderson, Oconee, Greenville, Laurens and Spartanburg Counties.

Iron and Copper Pyrites.

There is a large per cent of iron pyrites and copper pyrites associated with the gold deposits in many of the Virginia, North Carolina and Georgia gold mines. There is considerable mining of pyrites in Virginia. A valuable deposit has been opened up in Carter County, Tenn. There are a number of iron pyrites mines carrying a small percentage of copper, on the Southern Railway, and also a number of pyrites deposits.

Baryta.

Baryta is mined in Campbell and Pittsylvania Counties, Va., and in Western North Carolina. A mill at Lynchburg, Va., on the Southern Railway, grinds this rock and prepares it for shipment. A big deposit is being developed near Cleveland, Tenn.

Soapstone. Talc, Asbestos and Mica.

Talc and soapstone are in the same geological formation and are often associated with corundum. There are many excellent deposits in the South. The mining of talc is carried on in Swain and Cherokee Counties, North Carolina, and mills have been erected for grinding the talc prior to shipment. The talc mines of Cherokee County are at Tomotla, eight miles north of Murphy, the terminus of the Murphy Branch of the Southern Railway, and on the Nottely River some five miles southwest of Murphy. The Swain County mines are at Hewitts, on the Southern Railway. The talc of these counties is of very high grade. In Georgia talc is mined in one or two localities.

In Amelia and Albemarle Counties, Virginia, soapstone has been mined to a considerable extent. A great soapstone tray industry has been developed near Rockfish station, on the Southern Railway, Nelson County, Virginia. This belt runs through Albemarle and Campbell Counties.

There are soapstone and asbestos deposits in Pickens, Edgefield, Laurens, Abbeville, York and Spartanburg Counties, South Carolina. Soapstone is found in some places in Alabama. North Carolina mines can furnish large supplies of asbestos. In Virginia asbestos is found in good quality in Pittsylvania, Henry, Patrick, Amelia, Fauquier, Fairfax and other counties.

Considerable mica has been taken from the mines of Amelia County, Virginia. Deposits exist in Henrico and other counties. In North Carolina there are mines in Mitchell, Yancey, Jackson and Macon Counties. In Alabama mica is found in Chilton and other counties.

Gypsum (plaster) occurs in Virginia and elsewhere.

Rutile, albite, glass sand and other minerals are found in different sections of the South.

Salt.

There are deposits of salt in sections of Virginia; and in Kentucky, Tennessee and Alabama are found the salt-bearing rocks.

Lead, Zinc, Nickel and Tin.

Lead ores are found in North Carolina, Virginia and Tennessee. Zinc has been found in East Tennessee. Near Webster, N. C., nickel ore exists, while at King's Mountain, N. C., tin ore has been discovered. It also has been found in Nelson County, Virginia.

Petroleum.

Discoveries of petroleum have recently been made in the Cumberland Table-land District of Kentucky and Tennessee. Several rich wells have been sunk, and it is agreed that petroleum exists in large quantities. This oil field undoubtedly extends into Alabama, and some prospecting has been done in that State. The Southern Railway runs through supposed oil territory near Middlesboro, Ky., Jellico and Chattanooga, Tenn., and west of Florence, Ala.

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